

WHAT IS CLAIMED IS

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1. An optical scanner which irradiates a light beam to a scanned surface of an image support to form an electrostatic latent image on the image support surface, comprising:

    a light source emitting a light beam;

10       at least one reflection mirror having a reflection surface, a first axis parallel to a main-scanning correspondence direction on the reflection surface, and a second axis along the reflection surface and perpendicular to the first axis;

15       an optical element adjusting a position of a scanning line in a sub-scanning correspondence direction, the optical element having a beam-incidence surface, a third axis parallel to the main-scanning correspondence direction on the beam-incidence surface, and a fourth axis perpendicular to the third axis and along a beam-incidence direction;

20       a first adjustment unit provided to rotate said at least one reflection mirror around the second axis in order to attain uniformity of a scanning speed of the optical scanner in the sub-scanning correspondence direction; and

25       a second adjustment unit provided to rotate said optical element around the fourth axis in order to correct an inclination of

the scanning line in the sub-scanning correspondence direction to a desired position of the scanning line.

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2. An optical scanner which irradiates a light beam to a scanned surface of an image support to form an electrostatic latent image on the image support surface, comprising:

- 10        a light source emitting a light beam;
- at least one reflection mirror having a reflection surface;
- an optical element adjusting a position of a scanning line in a sub-scanning correspondence direction, the optical element having a beam-incidence surface, a first axis parallel to the main-scanning
- 15        correspondence direction on the beam-incidence surface, and a second axis perpendicular to the first axis and along a beam-incidence direction;
- a first supporting unit supporting a portion of said at least one reflection mirror;
- 20        a first adjustment unit provided to rotate said at least one reflection mirror about the first supporting unit in a direction perpendicular to the reflection surface and change a distance between the reflection surface and the image support surface in order to attain uniformity of a scanning speed of the optical scanner
- 25        in the sub-scanning correspondence direction;

a second supporting unit supporting a portion of said optical element; and

5 a second adjustment unit provided to rotate said optical element about the second supporting unit in a direction of the second axis in order to correct an inclination of the scanning line in the sub-scanning correspondence direction to a desired position of the scanning line.

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3. The optical scanner of claim 2 wherein the first supporting unit is provided at a first end of said at least one reflection mirror in the main-scanning correspondence direction outside a scanning 15 range of said at least one reflection mirror, and the first adjustment unit is provided at a second end of said at least one reflection mirror in the main-scanning correspondence direction outside the scanning range of said at least one reflection mirror.

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4. The optical scanner of claim 2 wherein the second supporting unit is provided at a first end of the optical element in 25 the main-scanning correspondence direction, and the second

adjustment unit is provided at a second end of the optical element in the main-scanning correspondence direction.

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5. The optical scanner of claim 1 wherein at least one of the first adjustment unit and the second adjustment unit is provided with an electrically driven actuator.

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6. The optical scanner of claim 1 wherein the first adjustment unit comprises a feed screw provided to move said at least one reflection mirror against an elastic actuation force of an elastic member that compresses said at least one reflection mirror toward the first adjustment unit.

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7. The optical scanner of claim 1 wherein the second adjustment unit comprises a feed screw provided to move the optical element against an elastic actuation force of an elastic member that

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compresses the optical element toward the second adjustment unit.

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8. The optical scanner of claim 7 wherein the feed screw of the second adjustment unit is rotated by an electrically driven actuator.

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9. The optical scanner of claim 5 further comprising:  
a detection unit detecting an error of the scanning speed of the  
15 optical scanner; and  
a control unit controlling driving of the actuator based on the  
scanning speed error detected by the detection unit.

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10. The optical scanner of claim 9 wherein said at least one reflection mirror is a half mirror, and the detection unit detects the error of the scanning speed based on a difference of detection times  
25 of the light beam detected by at least three photodetectors, said at

least three photodetectors being arranged on a back surface of the half mirror apart from one another at a given interval.

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11. The optical scanner of claim 1 wherein a plurality of image supports are provided, and the first adjustment unit and the second adjustment unit are provided respectively for each of the 10 plurality of image supports in an optical path where optical writing of each image support is carried out by the optical scanner.

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12. The optical scanner of claim 1 wherein a plurality of image supports are provided, one of the plurality of image supports includes a reference optical path, and the first adjustment unit and the second adjustment unit are provided respectively for each of the 20 remaining image supports other than said one of the plurality of image supports in an optical path where optical writing is carried out by the optical scanner.

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13. An optical-path adjustment method for an optical scanner which irradiates a light beam to a scanned surface of an image support to form an electrostatic latent image on the image support surface, the optical scanner including: a light source emitting a light beam; at least one reflection mirror having a reflection surface, a first axis parallel to a main-scanning correspondence direction on the reflection surface, and a second axis along the reflection surface and perpendicular to the first axis; and an optical element adjusting a position of a scanning line in a sub-scanning correspondence direction, the optical element having a beam-incidence surface, a third axis parallel to the main-scanning correspondence direction on the beam-incidence surface, and a fourth axis perpendicular to the third axis and along a beam-incidence direction, the method comprising the steps of:

5                   rotating said at least one reflection mirror around the second axis in order to attain uniformity of a scanning speed of the optical scanner in the sub-scanning correspondence direction; and

10                   rotating said optical element around the fourth axis in order to correct an inclination of the scanning line in the sub-scanning correspondence direction to a desired position of the scanning line,

15                   wherein the second rotating step is performed after the first rotating step is performed.

14. An optical-path adjustment method for an optical scanner which irradiates a light beam to a scanned surface of an image support to form an electrostatic latent image on the image support surface, the optical scanner including: a light source emitting a light beam; at least one reflection mirror having a reflection surface; an optical element adjusting a position of a scanning line in a sub-scanning correspondence direction, the optical element having a beam-incidence surface, a first axis parallel to the main-scanning correspondence direction on the beam-incidence surface, and a second axis perpendicular to the first axis and along a beam-incidence direction; a first supporting unit supporting a portion of said at least one reflection mirror; and a second supporting unit supporting a portion of said optical element, the method comprising the steps of:

15       rotating said at least one reflection mirror about the first supporting unit in a direction perpendicular to the reflection surface and changing a distance between the reflection surface and the image support surface in order to attain uniformity of a scanning speed of the optical scanner in the sub-scanning correspondence direction; and

20       rotating said optical element about the second supporting unit in a direction of the second axis in order to correct an inclination of the scanning line in the sub-scanning correspondence direction to a desired position of the scanning line,

25       wherein the second rotating step is performed after the first

rotating step is performed.

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15. The method of claim 13 wherein in the first rotating step a distance between the reflection surface of said at least one reflection mirror and the image support surface is changed by rotating a feed screw manually, and in the second rotating step an inclination of the 10. optical element in a direction perpendicular to the main-scanning correspondence direction is changed by an electrically driven actuator.

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16. The method of claim 13 wherein said at least one reflection mirror is a half mirror, and in the first rotating step an error of the scanning speed is detected based on a difference of 20. detection times of the light beam detected by three photodetectors.

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17. The method of claim 16 wherein in the first rotating step

the difference of detection times of the light beam detected by the three photodetectors is measured by turning on the light source, the three photodetectors being arranged on a back surface of the half mirror apart from one another at a given interval.

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18. The method of claim 16 wherein the optical scanner  
10 comprises a CCD camera.

15 19. The method of claim 17 wherein the distances of the photodetectors are stored in a memory device and the distances are read from the memory device when detecting the error of the scanning speed.

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20. An image forming apparatus comprising:  
an optical scanner which irradiates a light beam to a scanned  
25 surface of an image support to form an electrostatic latent image on

the image support surface; and

an image formation unit forming an image on a recording material based on the electrostatic latent image formed on the image support surface,

5 the optical scanner comprising:

a light source emitting a light beam;

at least one reflection mirror having a reflection surface, a first axis parallel to a main-scanning correspondence direction on the reflection surface, and a second axis along the reflection surface and perpendicular to the first axis;

an optical element adjusting a position of a scanning line in a sub-scanning correspondence direction, the optical element having a beam-incidence surface, a third axis parallel to the main-scanning correspondence direction on the beam-incidence surface, and a fourth axis perpendicular to the third axis and along a beam-incidence direction;

a first adjustment unit provided to rotate said at least one reflection mirror around the second axis in order to attain uniformity of a scanning speed of the optical scanner in the sub-scanning correspondence direction; and

a second adjustment unit provided to rotate said optical element around the fourth axis in order to correct an inclination of the scanning line in the sub-scanning correspondence direction to a desired position of the scanning line.

21. An optical scanner which irradiates a light beam to a scanned surface of an image support to form an electrostatic latent image on the image support surface, the optical scanner comprising:

5           a light source emitting a light beam;

5           at least one reflection mirror having a reflection surface, a first axis parallel to a main-scanning correspondence direction on the reflection surface, and a second axis along the reflection surface and perpendicular to the first axis;

10           an optical element adjusting a position of a scanning line in a sub-scanning correspondence direction, the optical element having a beam-incidence surface, a third axis parallel to the main-scanning correspondence direction on the beam-incidence surface, and a fourth axis perpendicular to the third axis and along a beam-incidence direction;

15           first adjustment means for rotating said at least one reflection mirror around the second axis in order to attain uniformity of a scanning speed of the optical scanner in the sub-scanning correspondence direction; and

20           second adjustment means for rotating said optical element around the fourth axis in order to correct an inclination of the scanning line in the sub-scanning correspondence direction to a desired position of the scanning line.

22. An optical scanner which irradiates a light beam to a scanned surface of an image support to form an electrostatic latent image on the image support surface, the optical scanner comprising:

5        a light source emitting a light beam;

      at least one reflection mirror having a reflection surface;

      an optical element adjusting a position of a scanning line in a sub-scanning correspondence direction, the optical element having a beam-incidence surface, a first axis parallel to the main-scanning correspondence direction on the beam-incidence surface, and a

10      second axis perpendicular to the first axis and along a beam-incidence direction;

      first supporting means for supporting a portion of said at least one reflection mirror;

      first adjustment means for rotating said at least one reflection mirror about the first supporting unit in a direction perpendicular to the reflection surface and changing a distance between the reflection surface and the image support surface in order to attain uniformity of a scanning speed of the optical scanner in the sub-scanning correspondence direction;

15      second supporting means for supporting a portion of said optical element; and

      second adjustment means for rotating said optical element about the second supporting unit in a direction of the second axis in order to correct an inclination of the scanning line in the sub-scanning correspondence direction to a desired position of the

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scanning line.

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23. An image forming apparatus comprising:

an optical scanner which irradiates a light beam to a scanned surface of an image support to form an electrostatic latent image on the image support surface; and

10 an image formation unit forming an image on a recording material based on the electrostatic latent image formed on the image support surface,

the optical scanner comprising:

a light source emitting a light beam;

15 at least one reflection mirror having a reflection surface, a first axis parallel to a main-scanning correspondence direction on the reflection surface, and a second axis along the reflection surface and perpendicular to the first axis;

an optical element adjusting a position of a scanning line in a 20 sub-scanning correspondence direction, the optical element having a beam-incidence surface, a third axis parallel to the main-scanning correspondence direction on the beam-incidence surface, and a fourth axis perpendicular to the third axis and along a beam-incidence direction;

25 first adjustment means for rotating said at least one reflection

mirror around the second axis in order to attain uniformity of a scanning speed of the optical scanner in the sub-scanning correspondence direction; and

5 second adjustment means for rotating said optical element around the fourth axis in order to correct an inclination of the scanning line in the sub-scanning correspondence direction to a desired position of the scanning line.

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